

## City of Lexington Fire Department

### Origin and Cause Report

Incident Date : 2018_06/13 Time of Alarm: 1355 (CAD actual 1420 hrs) Date of Report: 2018_06/20	Incident Address: 160 Kendal Dr. Lexington, VA. 24450 Open parcel adjacent to Rebel Ridge Rd.
Incident # : 18_17772 Case # : 18_17772	Origin: Explosives Operation
Investigator: T. B. Roberts	Cause: Insufficient Burden

#### I. Description

On June 13, 2018, at approximately 1330 hours, T.B. Roberts, City of Lexington Fire Marshal, reported to the premises of Kendal at Lexington, 160 Kendal Drive, Lexington, Virginia 24450.

Blue Ridge Rock Services, LLC. (BRRS), the explosives contractor, had scheduled an explosives operation to occur at approximately 1400 hours. The explosives operation was termed by Roberts as “Blasting Operation #17 (Blast#17).”

BRRS was a sub-contractor of Plecker Construction Company (PCC). Plecker Construction Company was the site management sub-contractor. Nielsen Builders was the General Contractor.

Roberts performed the pre-operation inspection of the blasting site. All parameters were in compliance. Roberts generally spoke with Kevin Fry of Nielsen Builders concerning Blast#17. Fry replied that the operation was proceeding as planned, and appeared slightly ahead of the 1400 hours scheduled detonation.

At approximately 1353 hours, BRRS detonated Blast#17 at Kendal Project, at the site known as Pond#2. Pond#2 was within an open field on the Kendal property. The nearest structure to Blast#17 was the private property at 111 Rebel Ridge Road, Lexington, Virginia. 24450.

Roberts was in attendance of the Blast#17 operation. Leslie Straughan, City Councilwoman, was in attendance at the operation as a guest of Roberts. Also present at Roberts’ observation location was Fry, Benny Matheny and Colby Richie. Matheny and Richie were employees of PCC. Edwin Martin and Drew Patterson were at the blasting site, a.k.a. the Round. Martin and Patterson were employees of BRRS.

Blast#17 resulted in flying debris, which escaped from the Round. Properties receiving debris were 208 Overhill Drive, 308 Overhill Drive, 111 Rebel Ridge Road and 597 Ross Road.

On June 21, 2018, reported was possible retaining wall damage at the property of 612 Ross Road.

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One injury of ringing ears was reported by Roy Ware. Ware was a laborer working for Orrison Tree Service. Ware reported, at the time of his injury, he was working outdoors at the premises of 207 Overhill Drive, Lexington, Virginia.

#### Affected properties:

1. 208 Overhill Drive, Lexington, Virginia, 24450, resident Alvin Carter. Earthen debris identified upon the lawn. Limited earthen debris identified at the SW area of the property. A section of tire shard was identified in that same area. The tire shard was a component of a blasting mat. No injury reported.
2. 308 Overhill Drive, Lexington, Virginia, 24450, resident Greg Raetz. Damage identified to the dwelling roof. Earthen debris was identified upon the exterior premises. No injury reported.
3. 111 Rebel Ridge Road, Lexington, Virginia, 24450, resident Margaret Shapiro Haskett. Earthen debris was identified upon the exterior premises, at the rear of the dwelling structure. No identified damage of the structure. No injury reported. Shapiro Haskett later sent an email to Roberts stating that her dwelling had a crack in a wall board (drywall). Roberts referred the complaint to BRRS for follow up. Note: the pre-blast survey and subsequent inspection determined the drywall cracking to be a pre-existing condition.
4. 597 Ross Road, Lexington, Virginia, 24450, owner Hunter McClung. Earthen debris reported to have entered the property. The property is undergoing renovation with much disturbed soil and foliage about the area. Unable to identify earthen debris consistent with the released debris from the explosives Round. No injury reported.
5. 612 Ross Road Lexington, Virginia, 24450, resident Elizabeth Schwartz. Roberts was contacted concerning a retaining wall, which had dislodged areas of skimming material. Roberts reported to inspect the wall. No injury reported. Note: Roberts referred the matter to BRRS for follow-up. Claude Finneyfrock, blasting contractor supervisor, telephoned Schwartz to schedule an inspection of the wall. Finneyfrock advised Roberts that Schwartz declined the inspection or to file a claim.

GoogleEarth was utilized to approximate the debris release or damage reported area. The estimated distances were:

- |  |          |
|--|----------|
| 1. Round to debris 208 Overhill Drive        | 260 feet |
| 2. Round to debris 308 Overhill Drive        | 339 feet |
| 3. Round to debris 111 Rebel Ridge Road      | 136 feet |
| 4. Round to reported debris at 597 Ross Road | 256 feet |
| 5. Round to 612 Ross Road                    | 930 feet |

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The weather conditions were mostly cloudy and warm. No measurable precipitation on June 13, 2018. Rain had occurred on June 11 and June 12, 2018.

The weather history for the Lexington area as provided by Phil Hysell of the NWS:

06/11/18	High Temp: 87	Low: 65	Precip: 0.08"
06/12/18	High Temp: 70	Low: 60	Precip: 0.41"
06/13/18	High Temp: 71	Low: 61	Precip: 0.00"

#### Parties:

Bissell, Elizabeth  
308 Overhill Dr.  
Lexington, Virginia 24450  
540 460 2809

Bright, Zachery  
Patrol Officer, Lexington Police Department  
11 Fuller Street  
Lexington, Virginia 24450  
540 462 3749

Carter, Alvin  
208 Overhill Dr.  
Lexington, Virginia 24450

Cullinane, John  
Assistant State Fire Marshal  
1005 Technology Park Drive  
Glen Allen, Virginia 23059  
540 266 4009

Dickerson, Tyson  
Fire Chief, City of Lexington  
708 S. Main Street  
Lexington, Virginia 24450  
540 463 3210

Ferrel, Brandon; witness of debris release  
HVAC contractor working at 308 Overhill Dr. (nos)  
540 490 2620

Finneyfrock, Claude  
Supervisor  
Blue Ridge Rock Services, LLC  
425 Cecil Wampler Road.  
Mt. Crawford, Virginia 22841  
540 271 2080

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Fry, Kevin  
Project Superintendent  
Nielsen Builders  
3588 Early Road  
Harrisonburg, Virginia 22801  
540 476 0816

Martin, Edwin  
Explosives Technician  
Blue Ridge Rock Services  
425 Cecil Wampler Rd.  
Mt. Crawford, Virginia 22841  
540 271 2080

Matheny, Benny  
Plecker Construction Company  
172 Parkersburg Turnpike  
Staunton, Virginia 24401  
540 292 3650

Patterson, Drew  
Bore Technician  
Blue Ridge Rock Services  
425 Cecil Wampler Rd.  
Mt. Crawford, Virginia 22841  
540 271 2080

Raetz, Greg  
308 Overhill Dr.  
Lexington, Virginia 24450  
540 463 9356  
DOB: 1949\_02/05

Richie, Colby  
Plecker Construction Company  
172 Parkersburg Turnpike  
Staunton, Virginia 24401  
540 246 1560

Schwartz, Elizabeth  
612 Ross Road  
Lexington, Virginia 24450  
540 460 5139

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Shapiro Haskett, Margaret  
111 Rebel Ridge Road  
Lexington, Virginia 24450  
435 258 8212

Simon, Noah  
City Manager, City of Lexington  
300 E. Washington Street  
Lexington, Virginia 24450

Sites, Steven  
Assistant State Fire Marshal – Special Operations  
State Fire Marshal's Office  
1005 Technology Drive  
Glen Allen, Virginia 23059  
540 266 4009

Smith, Robert  
Patrol Corporal, Lexington Police Department  
11 Fuller Street  
Lexington, Virginia 24450  
540 462 3749

Straughan, Leslie  
Councilwoman, City of Lexington  
300 E. Washington Street  
Lexington, Virginia 24450

Tyree, Tony  
2143 Irish Creek Rd.  
Vesuvius, Virginia 24483  
540 377 6767

Ware, Roy  
Ware is presumed a resident of the Lexington, Virginia area.  
Ware did not present an address or contact information.

### II. Observations

On June 13, 2018 at 1340 hours, I performed the pre-blast inspection of the Blast#17 site. Upon my arrival, the cover blasting mats were being placed atop the Round by an excavator equipment.

The explosives transport vehicle and drilling equipment had been removed from the Hot-Zone to the Cold-Zone. Martin was present at the Round with a BRRS pickup truck. The operation appeared slightly ahead of the 1400 hours scheduled detonation.

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The Round was configured with its SW slope grade elevated in comparison to its NE grade. At approximately 1352 hours, the blasting site had been prepared. The immediate blast zone had been evacuated of persons and mobile equipment.

Matheny received a cellular telephone call. The presumed caller was either Martin or Finneyfrock. Matheny inquired of me as to if Blast#17 could proceed. I authorized the detonation. Matheny verbally conveyed my authorization to the caller via cellular telephone.

The three-cycle site-warning siren was sounded and audible. Martin announced the verbal warning. The detonation was initiated by Martin.

At detonation, I witnessed mats at the SW end of the Round lift and displace. A heave of the site soil was noticeable. A column of vertical energy release and debris was noted to escape the SW end of the Round. I witnessed debris exiting the Round in a vertical, NE and easterly trajectory.

A second column of vertical energy release was noted at the NE end of the Round. This column presented as more of a "shotgun" release and occurred approximately milliseconds to a second after the first, SW end of the Round explosives energy release.

The NE, second column release, was narrow in circumference as compared to the first, SW column release. I did not note debris exiting the Round with the second column release. The second released column quickly dissipated as compared to the first released column. Review of the Blast#17 video indicated that stemming material was likely ejected with the second, NE, column release. The stemming material did not appear to exit the boundaries of the Kendal property. No evidence was identified to indicate that the stemming material had discharged from within the boundaries of the Kendal property.

An immediate verbal Stop-Work-Order for the explosives operation was issued to Fry by me.

I could hear persons shouting from the direction of Overhill Drive. The shouting persons were not visible from my position. I could detect, first a female voice, and several seconds after the female voice, I could hear a shouting male voice. From my position, I was unable to understand what the two persons were saying.

I entered my vehicle and departed my observation area. I drove my vehicle in proximity to the Round. I stopped my vehicle within the Warm-Zone. I observed Martin, on foot, approach the Round. I observed as Martin inspected the Round. I did not enter the Hot Zone until Martin advised Patterson to sound the all-clear siren. The single siren was sounded and audible indicating the all-clear signal.

I approached Martin and inquired as to if he had sustained injury. Martin replied that he was "okay." I inquired of Martin as to if Patterson was injured. Martin replied of Patterson, "I don't think so." I inquired of Martin as to what happened? Martin replied, "I don't know." Martin was sweating, and his skin was pale. I again inquired of Martin as to his wellbeing, noting his physical appearance. Martin stated that he was "okay."

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The shouting continued from the direction of Overhill Drive. I departed Martin's position and walked to the erosion fence on the Kendal property. The erosion fence was adjacent to the property line of 208 and 308 Overhill Drive.

I encountered a middle-aged female and an older male. The female was later identified as Elizabeth Bissell. The male was later identified as Greg Raetz. Bissell is Raetz's daughter. Bissell resides at 308 Overhill Drive. Raetz was the property owner and resident of 308 Overhill Drive.

I approached Bissell. Bissell stated her opinion of the incompetence of the City, of Kendal, and of the blasting contractor. Bissell stated that her young daughter was asleep on the second-floor of the dwelling, and that debris had struck and damaged the dwelling roof where the child was asleep.

Raetz joined Bissell at the erosion fence. Raetz reiterated Bissell's comments.

After Bissell and Raetz subsided with their statements to me, I identified myself to the both parties. I inquired as to if any person was injured. Bissell stated that no one was injured. I verbalized my regrets that the blasting had affected both Bissell and Raetz. I informed Bissell and Raetz that I would respond to their property for an investigation. Raetz issued his verbal consent for me to enter his property. Raetz stated that the police had been called. I informed Bissell and Raetz that I was glad to know that no injuries had occurred.

Matheny and Richie had approached the erosion fence to join me. Bissell and Raetz verbally expressed their displeasure to Matheny and to Richie.

Raetz stated that an HVAC contractor was working at his house. Raetz stated that the contractor heard the blast, and was a witness of the debris entering the Raetz property. The contractor was ready to depart the Raetz property. From my position, I saw a contractor's van at the Raetz premises. I requested of Raetz to obtain the contractor's name and telephone contact on my behalf.

I returned to my vehicle. Finneyfrock had driven a BRRS pickup truck alongside of my vehicle. I issued the verbal Stop-Work-Order to Finneyfrock. I informed Finneyfrock that all blasting activities and operations were to cease. I informed Finneyfrock that the Explosives Permit was suspended pending investigation of the incident.

I requested of Finneyfrock and Fry to report to 308 Overhill Drive to speak with Bissell and Raetz. Both Finneyfrock and Fry complied with my request.

I departed the scene with Straughan. I attempted to contact Tyson Dickerson via cellular telephone. Dickerson did not answer my call. I contacted Noah Simon via cellular telephone. Simon was briefed of the situation. I returned Straughan to her place of business.

After returning Straughan to her place of business, I proceeded to my office to retrieve a camera. I reported to 308 Overhill Drive at approximately 1422 hours.

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Upon arrival at 308 Overhill Drive, I encountered on the lawn Fry, Finneyfrock, Bissell, Raetz, Matheny and two Lexington Police Officers, Robert Smith and Zachery Bright. The CAD record shown that Bissell had notified 9-1-1 for a police response (reference: CAD 18\_17769).

On the driveway of the Raetz premises, I spoke with Fry and Finneyfrock. Both assured that they were assisting the homeowner.

I spoke with Smith and Bright. Bright was the primary officer. Bright stated that he had spoken with Bissell and Raetz. Bright photographed the damage to the dwelling roof, and photographs of the earthen debris upon Raetz's property. I informed Bright and Smith that I would conduct the investigation. Both police officers cleared the scene. Bright later provided his photographs to me via cellular text message (reference: Photos LPD).

I encountered Raetz upon his lawn, outside of his dwelling. I re-introduced myself to Raetz. I again inquired of Raetz as to if any person was injured. Raetz stated that no one was hurt. I inquired as to what damage was sustained by his property or structures. Raetz replied that there are rocks and mud all over the yard, and that his roof was damaged. I inquired of Raetz as to if any of the vehicles parked at the premises were damaged. Raetz inspected all personal vehicles parked at the dwelling. I accompanied Raetz during his survey of the vehicles. Raetz did not identify any damage to the parked vehicles. I obtained photographs of the vehicle license plates (reference: Photographs 1241 – 1244).

The HVAC contractor - Raetz identified Ferrel as the HVAC contractor working at the Raetz property. Ferrel was identified by Raetz as being a witness of the blast noise and debris entering the Raetz property. Raetz conveyed to me Ferrel's telephone contact information. Ferrel had departed the Raetz premises prior to my arrival. Raetz stated that Ferrel did not complain of injury. I did not contact Ferrel.

Raetz and Bissell had returned to the interior of the dwelling as I conducted the exterior investigation. I did not inspect the interior of the structure.

The Raetz structure is a Type-III construction, residential dwelling. The roof covering is a slate material. I noted one slate tile dislodged from the roof, to the right of the Side-A, left dormer, approximately at the middle of the roof. The dislodged tile was resting atop the front entryway roof. A dirt clump consistent with the released blast debris was atop the entryway roof, lying adjacent to the dislodged tile. I determined it plausible that the dirt clump struck and dislodged the slate roofing tile. (reference: photographs 1224-1227)

I conducted a survey of the Raetz' exterior property. Earthen debris was identified in multiple areas of the exterior property. No rock material was identified upon the property that would be consistent with the rock associated with the Pond#2, Blast#17 site. The size of the earthen debris ranged from a centimeter or two in circumference, to clumps of earth approximately the size of a human hand. (reference photographs 1226-1239; 1245-1249)



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While I at 308 Overhill Drive, I was approached by Roy Ware. Ware was working outdoors for Orrison Tree Service (OTS) at the premises of 207 Overhill Drive, Lexington, Virginia 24450. Ware advised that he heard the blast and saw the debris coming his way. Ware complained of his ears ringing post the explosion.

I offered Ware Emergency Medical Services (EMS) assistance, which Ware refused. I advised Ware to follow-up and seek medical attention with a physician. I liaison a contact between Ware and Finneyfrock for insurance claim purposes. Ware did not advise of an address or contact information. As of this report, I do not know the disposition of Ware's complaint or health.

I departed the premises of 308 Overhill Drive at approximately 1540 hours.

At 1549 hours, I returned to the explosives site Pond#2 at the Kendal at Lexington property. I noted that one blasting mat was contorted and displaced from atop the SW end of the Round. There was tire matting absent from that blasting mat. The blasting mat cables appeared to have remained intact. (reference: photographs 1252; 1255-1258; 1262-1263)

A second blasting mat was displaced from the SW end of the Round. No damage noted to that blasting mat. (reference: photographs 1250; 1253-1254)

The SW end of the Pond#2 Round contained large and displaced rock. There existed an obvious crater within the fractured rock. The crater was approximately seven feet in circumference, and a foot to two feet in depth from grade. (reference: photographs 1250-1253; 1261-1262)

The NE end of the Round, where the second "shotgun" vertical energy release occurred, appeared as my experience with previous detonations at the Kendal site. I did not note an obvious crater or other indicator that this area had released any subsurface material. (reference: photographs 1250; 1259-1260)

I departed the Kendal property, Pond#2 explosives site, at approximately 1735 hours.

### III. Interview

#### **2018\_06/14, 0852 hours, Cullinane**

I telephoned the Virginia Department of Fire Programs, State Fire Marshal's Office (VD FP/FMO). Marshal John Cullinane answered my call. I briefed Cullinane as to the situation of Blast#17. Cullinane contacted Marshal Steven Sites to return my call.

Marshal Sites returned my call. I briefed Sites of the situation related to the Blast#17 operation. Sites was requested to review the documentation submitted by BRRS to me. I forwarded the documentation to Sites via email.

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Sites reviewed the documentation. Sites and I identified two violations of Code. One violation involved the air blast parameter exceeding the allowable upper limit. The second violation of VSFPC 5607.16 was a BRRS documentation omission.

See Sites review attached to this report.

#### **2018\_06/14, 1100 hours, Tyree**

I had been informed by Simon that the premises owned by Hunter McClung at 597 Ross Road had experienced debris from Blast#17.

I reported to the address. I encountered McClung and several additional construction workers. McClung is the property owner. 597 Ross Road is undergoing renovation, and is not an occupied dwelling.

McClung stated that he was not at the premises on June 13. McClung stated that one of his workers, Mr. Tony Tyree, had witnessed debris from the blast. I inquired as to if Tyree was on the premises. McClung summoned Tyree.

I introduced myself to Tyree. Tyree was pleasant and cooperative. Tyree verbally consented to the interview. Tyree was a tradesman working at the premises.

I inquired of Tyree as to if he was on premises and witnessed the events of the June 13 blast. Tyree affirmed that he was working at the premises. I inquired of Tyree if he or anyone else at the job site had been injured. Tyree denied that any injury had occurred.

I asked Tyree to account his story of June 13. Tyree stated that he was standing outdoors of the structure. Tyree heard the three-cycle warning siren. Tyree heard the detonation. Tyree stated that he felt the air blast. Tyree stated that he did not visualize the debris, but could immediately hear stuff raining down through the trees. The released debris did not reach Tyree or the structure or their near proximity.

Tyree stated that he could hear debris striking the roof of the house next door (later identified as 111 Rebel Ridge Road). Tyree added that the people at 111 Rebel Ridge Road were moving into the house. Tyree stated that he had just seen a woman at the 111 Rebel Ridge Road driveway.

I departed 597 Ross Road at approximately 1120 hours.

#### **2018\_06/14, 1123 hours, Shapiro Haskett**

I stopped at the driveway of 111 Rebel Ridge Road. I noted a female standing upon the driveway. I exited my vehicle. I introduced myself to Margaret Shapiro Haskett. Shapiro Haskett is the property owner of 111 Rebel Ridge Road.

I explained the events of Blast #17 to Shapiro Haskett. I inquired of Shapiro Haskett as to if she had witnessed the events of June 13. Shapiro Haskett stated that her family and she are just moving into the dwelling, and that no one was present on June 13.

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I requested to enter the property to conduct an inspection. Shapiro Haskett gave verbal consent to enter the property.

With Shapiro Haskett, and from grade, she and I observed the roof of her dwelling. No debris or damage was noted. I inspected the exterior of the structure. I did not observe damage to the exterior of the structure. I inspected the yard. Debris consistent with the released debris of Blast#17 was noted at the rear of the property. The observed debris ranged in size from a centimeter or two, to three observed clods of soil approximately the size of a human fist.

I issued my contact information to Shapiro Haskett. I requested Shapiro Haskett to contact me if she identified any damage or if I could assist in any fashion.

I departed 111 Rebel Ridge Road at approximately 1140 hours.

#### **2018\_06/19, 1135 hours, Finneyfrock**

I met with Claude Finneyfrock. The interview was conducted at the Nielsen construction trailer, on the premises of the Kendal Project. Finneyfrock was the BRRS explosives technician supervisor in attendance of Blast#17. Finneyfrock has approximately 40 years of experience dealing with explosives.

Finneyfrock had witnessed a like event of the June 13 occurrence only once in his past professional experience. Finneyfrock stated that the June 13 operation seemed normal during setup. Finneyfrock had no indication or indicators that the detonation would not proceed as anticipated.

Finneyfrock accounts that one seismograph equipment was placed adjacent to 111 Rebel Ridge Road. 111 Rebel Ridge Road was the nearest structure.

I inquired as to the seismograph ground vibration record and its air blast record. The ground vibration was within allowable parameters, at below 1 for the three criteria. The air blast record was 139 db/P.S.I.

The Round was 59 bores. The explosive and emulsion used was 2x8 Dynamax Pro and 2x16 Blastex respectively. Both the explosive and emulsion were a packaged product. The stemming material was #8 crushed stone.

I inquired as to if Finneyfrock encountered moisture within the bores. Finneyfrock stated that they, the explosives technicians, were aware of moisture within the bored holes. Finneyfrock stated that the Dynamax Pro and Blastex were a moisture rated explosive and emulsion. Finneyfrock added that Dynmax Pro and Blastex are relatively "tame" in comparison to other explosives and emulsions. Finneyfrock stated that he was surprised by the resulting explosion and debris release from the Round, especially given that the industry considers the utilized blasting agents as tame.

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I asked Finneyrock to offer his experienced opinion of what may have occurred with the detonation on June 13. Finneyrock stated his opinion that the explosive may have been placed near a mud-seam within the rock. The mud-seam would react to the explosive energy in a different way than it would react with rock.

#### **2018\_06/19, 1135 hours, Martin**

I met with Edwin Martin. The interview was conducted at the Nielsen construction trailer, on the premises of the Kendal Project. Martin is the BRRS explosives technician that detonated the explosives on June 13. Martin has approximately 30 years of experience dealing with explosives.

Martin had witnessed a like event of the June 13 occurrence once during his past professional experience. Martin stated that the June 13 operation seemed normal. Martin had no indication or indicators that the detonation would not proceed as anticipated.

Martin stated that he had properly prepared the operation site, a.k.a Round. The site bores were a 6'x6' grid, there existed 59 holes bored for the Round.

Martin was aware of a mud-seam within the rock formation. The mud-seam was approximately three-feet to four-feet in depth from grade. The mud-seam was noted and the Round was prepared as to not be effected by the mud-seam.

Martin stated that all bores were inspected for proper depth. All explosive charges and emulsions were inspected for depth and proper loading.

Martin stated that the explosive and bore technicians can gain about a 3% to 5% understanding of the subsurface geology when boring the Round grid. The remaining 97% to 95% understanding of the subsurface geology is speculative based upon job experience. Martin stated that there exist unknowns about the subsurface rock formation, which cannot be determined from the drilling operation.

I inquired of Martin if, in his opinion, was the explosive placed in near proximity of a mud-seam, and would a mud-seam be detectable by Patterson and/or him during the drilling process. Martin stated that Patterson and he did detect a mud-seam within the rock while drilling the bores. Martin is confident that the explosives were not placed in proximity to the identified mud-seam.

I inquired of Martin as to if the bores were moist or wet. Martin did not encounter actual measurable water within the bores, but was aware that the bores contained moisture. The explosive and emulsion utilized are rated for moisture application.

I inquired of Martin as to if all bores were inspected for depth post drilling and post loading the explosives. I asked Martin if there was a chance that any bores were short-loaded (short-loaded: not loaded to the proper depth). Martin stated that Patterson tags each bore with a label stating the depth and width, and other information pertinent to the operation. Martin stated that each bore was inspected for depth pre and post loading with explosives.

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Additionally, Martin verified his depth and loading findings against Patterson's bore-tag data. Martin stated that all information was consistent and verified. Martin identified no issues. Martin was confident that no bores were short-loaded. Martin added that Patterson is the most conscientious and best driller, with who Martin has ever worked.

I inquired of Martin if there was a possibility that any bores were over-loaded or overcharged with explosives. Martin stated that he and Patterson verify every loaded bore against the label data. Additionally, the detonation cord exits the bore after the explosives are loaded into the ground. The detonation cord acts as a visual indicator that the bore is loaded. Martin also inspects the bore for depth after the explosives are loaded. An over-loaded or over-charged bore would be identifiable with the post-load depth inspection, and the other indicators.

I asked Martin to offer his experienced opinion of what may have occurred with the detonation on June 13. Martin stated his opinion that below the surface, the rock formation likely was not as substantial in an area of an explosive charge. Where the technicians anticipated a rock formation to exist, there may have actually existed soil. Rock will contain the explosive energy, whereas soil will not sustain that equal level of energy. That circumstance may create the untoward reaction to the explosives energy. The circumstance is referred to as state of inadequate or insufficient burden. Insufficient burden is a circumstance, which typically cannot be detected by the explosives technicians while drilling or otherwise.

#### **2018\_06/19, 1242 hours, Patterson**

I met with Drew Patterson. The interview was conducted at the Nielsen construction trailer, on the premises of the Kendal Project. Patterson is the BRRS drill technician that attended the explosives operation on June 13. Patterson has +/- seven years experience with BRRS. Patterson was employed as a quarry driller prior to his employment with BRRS.

I inquired of Patterson as to the Round and bore data. Patterson stated that the Round was a 6'x6' grid pattern. The bores were eight to twelve feet in depth. The bores were 3.5" in diameter. There were 59 bores with this operation.

I inquired of Patterson as to if there was any indication that the explosives operation would not proceed as expected. Patterson stated that there was no indication of a potential problem or pending failure; all seemed normal with the operation.

I inquired of Patterson as to if he had previously experienced an errant operation. Patterson stated that he has only experienced one operation in his career, which did not go as planned. That untoward operation occurred during his quarry drilling experience.

I inquired of Patterson as to if he was aware of a mud-seam within the rock formation or any other issues with the rock or operation. Patterson stated that Martin and he were aware of a mud-seam within the rock formation. The mud-seam was approximately at three to four feet in depth from grade. Patterson is confident that the explosives were not loaded within

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proximity to the identified mud-seam. Patterson did not identify any issues with the operation.

Patterson stated that he labels each bore with data pertinent to Martin and him. As Martin loads the explosives into the ground, Martin and Patterson verify the labeled data. Additionally, Martin inspects all bores and loads for proper depth.

I inquired of Patterson if there was a possibility that any bore was short-loaded or over-charged. Patterson was confident that no bores were short-loaded or over-charge loaded.

#### **2018\_06/20, 0810 hours, Carter**

I reported to the residence at 208 Overhill Drive. Mr. Alvin Carter answered my knock at his door. I explained the circumstances of the June 13 incident. Carter stated that he was not aware of the incident. I inquired of Carter if he had noticed any damage to his property. Carter replied that he had not noted any damage. I requested to inspect the exterior of Carter's property. I asked Carter to contact me if he identified any damages relating to the blasting incident. I informed Carter that if I identified any damage to his property, that I would report such to him. Carter issued verbal consent to enter his property.

I inspected the exterior of Carter's dwelling. No debris or damage was noted to the structure or to the vehicles parked upon Carter's driveway.

I inspected the exterior lawn area of Carter property. At the SW area of the Carter property, I did note soil debris consistent with the released debris from Blast#17. I did not identify any soil debris nearer than approximately 160 feet of Carter's dwelling structure. No rock debris was observed.

The released shard of tire from the blasting mat was upon the Carter property, not upon the Raetz property as originally assumed. I did photograph the tire shard during my inspection of the Raetz property. The tire shard rested approximately 200 feet from Carter's dwelling structure. (reference: photograph 1229)

There were two vehicles parked at the Carter SW property, an older model pickup truck and an older model tractor. No damage to either vehicle was noted.

I departed 208 Overhill Drive at approximately 0835 hours.

#### **2018\_06/21, 1150 hours, Schwartz**

I was contacted via email by Elizabeth Schwartz of 612 Ross Rd. Lexington, Virginia. Schwartz stated that she was not at her residence on June 13, but had returned home to find an exterior retaining wall had material, which was dislodged from the retaining wall. I contacted Schwartz via telephone and scheduled a visit to inspect the wall.

#### **2018\_06/21, 1210 hours, Schwartz**

I reported to the 612 Ross Road, Lexington, Virginia. I met with Schwartz outside of her dwelling. Schwartz shown one area of the Side-A retaining wall, which had dislodged

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skimming material. The Side-D exterior retaining wall had two areas of dislodged skimming material. The dislodged skimming mortar was lying upon the ground, adjacent to the damaged areas of the retaining wall. Schwartz stated that the wall was old, and does have existing deteriorating conditions. Swartz was not confident that the blasting had damaged the wall.

Inspection of the retaining wall revealed that the wall was an aged structure. Evident was that the wall had previously been patched/skimmed with cover mortar. Paint had been applied to the wall. There were approximately three areas of the wall, where skimming mortar had dislodged from the wall. I did not note that the wall structure had failed, but did note the cosmetic deterioration of the wall. (reference: photographs 1264-1266)

I cannot determine if the explosion of Blast#17 caused the material to dislodge from the Schwartz retaining wall. The matter was referred to BRRS for follow up.

I departed 612 Ross Road at approximately 1210 hours.

Note: Finneyfrock telephoned me later in the day on June 21, 2018. Finneyfrock had telephone contacted Schwartz. Finneyfrock stated that Schwartz advised Finneyfrock to not worry about the wall, that the wall had existing deterioration. Schwartz would not be filing a claim.

#### IV. Documentation

Blaster Permit, Finneyfrock BRRS  
Blaster Permit, Martin BRRS  
CAD, LFD  
CAD, LPD  
Explosives Permit, release agreement  
Explosives Permit, release agreement, amended, Elrod  
Explosives Permit, Resume Work Order  
Explosives Permit, Stop Work Order  
Form, Blasting Complaint Investigation  
Inspection report, VCE, 111 Rebel Ridge  
Insurance statement, Campbell Insurance  
Investigation question/reply, Finneyfrock  
Map, debris area distance measurement. GoogleEarth  
Map, distance measurement, 612 Ross Road. GoogleEarth  
Map, distance measurement, Ware. GoogleEarth  
Near structure report, BRRS  
Photograph, LPD, Bright  
Photograph, Overhill Dr., 308  
Photograph, Ross Rd., 612  
Photograph, Round site  
Report, Blast Record, BRRS  
Report, Bore Record, BRRS

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Report, NFIRS  
Report, Seismograph Calibration Certificate, BRRS  
Report, Seismograph Record, BRRS  
Report, Transport Manifest, BRRS  
SFMO review, Sites  
Statement, Finneyfrock, BRRS  
Statement, Matheny, PCC  
Statement, Richie, PCC  
Video of detonation  
Video of detonation, still images  
Weather data, NWS

### V. Conclusion

On June 13, 2018, at approximately 1355 hours, an explosives operation was being conducted by Blue Ridge Rock Services (BRRS). BRRS is a sub-contractor for Plecker Construction. Plecker Construction is a sub-contractor for Nielsen Builders. Nielsen Builders is the general contractor for the Kendal Project.

The explosive operation was conducted upon the premises of the Kendal at Lexington construction project, 160 Kendal Drive, Lexington, Virginia 24450. The explosives operation was conducted at the area identified and known by Nielsen Builders as Pond#2.

City of Lexington, Virginia, Fire Marshal T.B. Roberts was in attendance of the explosives operation. The operation is identified by Roberts as Pond#2; Blast#17. Roberts was a witness to explosives operation. Roberts witnessed the errant and untoward reaction to the released explosives energy.

The Blast#17 operation was the first to be conducted at Pond#2. In conversation among other investigators and Roberts, a general consensus is that errant blasting operations occur with the first explosives operation at a given blasting site. The consensus is attributed to the speculations and unknowns related to the subsurface geology and/or the rock formation reaction to the energy of an explosive charge(s).

The Pond#2 site release of the explosives energy resulted with a vertically discharged energy release. The vertical release of energy resulted with the ejection of earthen debris and blasting mat debris from the South West end of the explosives operation site, a.k.a the Round.

Additionally, Roberts witnessed the vertical release of explosives energy from the North East end of the Round. The NE energy release appeared as a “shotgun” type ejection. The plume was narrow, quickly reactive, and quickly dissipating in comparison to the SW energy release. Review of the video and video still-photographs did indicate that stemming material was likely released from the NE end of the Round. There exists no indication or findings that the probable released stemming material entered properties adjacent to the Pond#2, Kendal at Lexington property.



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The released debris from the SW end of the Round entered four local properties. Damage occurred to the dwelling structure located at 308 Overhill Drive, Lexington, Virginia 24450.

The retaining wall at 612 Ross Road Lexington, Virginia 24450 may have been effected by ground vibration related to Blast#17. The approximate distance from the Round to the address is 930 feet. My opinion is that the ground vibration at ~930 feet would be minimal, and is not the likely cause of the wall skimming mortar failure. The property owner of the retaining wall did not file a damage claim with BRRS.

One injury was reported by an employee of Orrison Tree Service (OTS). OTS employees were working at the exterior premises of 307 Overhill Drive, Lexington, Virginia 24450. The employee of OTS stated that his ears were ringing post the blast. The OTS employee refused EMS response and assessment. The employee was advised to seek medical evaluation. The injury claim was referred to BRRS.

The investigation did not identify any rock material released from the SW Round onto adjacent properties. Identified released material was clay type soil, and a tire shard from a blasting mat. The soil released from the Round ranged in size from dust particles to earthen clods approximately 8cmx16cm. A tire shard approximately 2'x8" from a blasting mat was ejected onto the property of 208 Overhill Drive, Lexington, Virginia 24450.

Review of the video, still-photographs, indicated that there exists a probable stemming material release from the second energy plume, at the NE Round. There was no evidence to indicate that the stemming material had entered properties adjacent to the Kendal at Lexington property.

The structure at 308 Overhill Drive, Lexington, Virginia 24450 sustained damage to its roof from ejected soil. A clod of soil was determined to have struck the slate roof. A slate roofing tile was dislodged from the roof. The damage claim was referred to BRRS.

The theory of the untoward release of energy from the explosives operation, initial plume, on the SW end Round, involves burden. Burden is an industry term utilized to generally define, "the distance from an explosives charge to the nearest free or open face. Technically, there may be an apparent burden and a true burden, the latter being measured always in the direction in which displacement of broken rock will occur following firing of an explosives charge." (reference: Blasting Terminology)

The SW end of the Round theory involves a circumstance of insufficient burden. One or more of the drilled bores is thought to have been adjacent to an area of the rock formation, where the rock formation either was insufficiently dense or potentially absent, e.g. a void area containing soil in lieu of rock. The lack of burden or failure of the burden to contain the explosive energy resulted in the release of the explosive energy in a violent, untoward and vertical trajectory.

The NE end, second plume, of the Round theory involves a circumstance of ejected stemming material. Stemming material compresses when an explosive is detonated. When

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the adjacent rock formation(s) fracture, the stemming material loses its compressive state. If the rock formation fractures in such a manner so as the compressed stemming material is not dissipated, the stemming material may be ejected either on a horizontal or vertical plane, or on both planes. The ejection of stemming material is not an unusual occurrence. Generally with a vertical plane ejection of stemming material, the stemming material will be suppressed by blasting matting, when a blasting mat is being utilized. For the NE release of energy, the blasting mat did not fully suppress the vertical release of the stemming material.

Blue Ridge Rock Services, LLC was determined in violation of the Virginia Statewide Fire Prevention Code, Section: 5607.16. The violation was a documentation omission. BRRS explained the omission as the seismograph manufacturer requires a mathematical equation to determine the omitted Blast Report data. BRRS did not possess that mathematical formula so as to calculate the omitted data. No action was taken concerning this violation as the explanation of omission was accepted.

Blue Ridge Rock Services, LLC was determined in violation of the allowable air blast parameter. The allowable air blast is 129 db/P.S.I. Blast#17 presented with a 139.47 db/P.S.I. My opinion is that the air blast violation occurred subsequent to the errant blasting event. There was no intentional or negligent act by the explosives technician(s) to exceed the air blast parameter. No action was determined required related to the air blast violation.

On June 29, 2018, Kendal at Lexington, offered to adjust its notification procedures related to future explosives operations. Kendal at Lexington offered to amend and improve its notification procedures to persons subscribed to the Project and blasting notification messaging. The procedural offers were accepted by the City of Lexington as a condition to reinstatement of the City of Lexington, Virginia, Explosives Permit 18\_001.

On June 29, 2018, Nielsen Builders, Plecker Construction and Blue Ridge Rock Services, LLC offered to adjust and amend procedures, which will improve the site audible warning signal. The contractors additionally offered to adjust and amend operational procedures, which when applied, may lessen or abate potential debris releases during future blasting operations, if an errant blast was to occur. The procedural offers were accepted by the City of Lexington as a condition to reinstatement of the City of Lexington, Virginia, Explosives Permit 18\_001.

The City of Lexington, Virginia, Explosives Permit 18\_001 was reinstated. Blue Ridge Rock Services, LLC was authorized to resume explosives operations on July 5, 2018 at 0700 hours.